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WORKPIECE HOLDING MECHANISM FOR A PLANE POLISHING DEVICE

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Claim

1. A workpiece holding mechanism for a plane polishing device characterized in that it contains a holding part, which holds a workpiece that is on top of the polishing surface of the plane polishing device and is equipped with a convex spherical surface centering around one point on the surface of the said workpiece to be processed; a support part, which is provided for maintaining a constant orientation and is equipped with a concave spherical surface, which engages with the aforementioned convex spherical surface in a freely oscillating manner centering about one point on the aforementioned workpiece; and a flexible body, which is provided between the aforementioned holding part and the aforementioned supporting part and has high torsional rigidity but can bend freely.

Detailed explanation of the invention

Industrial application field

The present invention concerns a workpiece holding mechanism for a plane polishing device. In particular, it concerns a holding mechanism for a workpiece in a plane polishing device which polishes the surface of thin plates.

Prior art

Generally, a workpiece holding mechanism for a plane polishing device is constructed to include a holding area, where the workpiece is held on top of a polishing surface of the plane polishing device, and the surface of the workpiece is polished by oscillating [vibrating while moving] the workpiece over the polishing surface.

Figure 2 is a longitudinal section of a workpiece holding mechanism for a plane polishing device of the prior art. In Figure 2, a disk (1) of the plane polishing device is rotated about a shaft (2). Also, a sleeve (4) is attached to a frame (3) of the plane polishing device in a freely rotatable manner, and a splined shaft (5) is attached to the central hole of this sleeve (4) in a freely movable manner in the direction of the shaft and in such a manner that it rotates together with the sleeve (4) about the shaft. A lever (7), which is attached to an air cylinder (6) provided for the frame (3), engages with the splined shaft (5) in a freely rotatable manner. Also, a gear (9), which is attached to a motor (8) provided for the frame (3), engages with a gear (10), which is provided at the sleeve (4).

A hemispherical body (11) engages with the curved area in the form of a spherical surface that is provided at the front end of the splined shaft (5) in a freely oscillating manner. A pressing plate (12) is fixed to the hemispherical body (11), and a frame (13) is provided at the pressing plate (12). A pin (14), which is provided at the frame (13), engages with a groove (15), which is provided at the front end of the splined shaft (5). A compression spring (16), which is provided between the splined shaft (5) and the frame (13), interacts to press the hemispherical body (11) onto the splined shaft (5) in order to prevent the hemispherical body (11) from falling when the splined shaft (5) ascends.

A through-hole (17), which is provided at the pressing plate (12), and a through-hole (18), which is provided between the hemispherical body (11) and the pressing plate (12), are connected to a vacuum pump (not shown) through a pipe (19), which passes through a hole provided at the splined shaft (31), in order to vacuum hold material (20), which is a magnetic disk forming the workpiece, onto the pressing plate (12). A ring (21) is also provided and fixed at the pressing plate (12) in order to determine the position of the material (20).

To polish the surface of the material (20) with this plane polishing device, the air cylinder (6) is actuated so that the pressing plate (12) ascends and so that the material (20) is vacuum held against the inner side of the ring (21) at the lower surface of the pressing plate (12). Next, the pressing plate (12) is lowered by the air cylinder (6) through rotation of the motor (8), and the material (20) is pressed against the polishing surface (22) of the disk (1). Also, a polishing solution (not shown) is spread over the polishing surface (22). Accordingly,

the bottom surface of the material (20) is polished by the action of its own rotations and vibrations by the rotation of the disk (1).

The polishing surface (22) of the disk (1) is processed to have a flat surface; however, a small amount of waviness remains in many actual cases. Accordingly, it is necessary for the material (20) and the pressing plate (12) to be able to tilt slightly along the waviness of the polishing surface (22) in order for the material (20) constantly to adhere close to the polishing surface (22) for a smooth finish. This tilting is obtained when the hemispherical body (11) vibrates with the spherical concave area of the splined shaft (5). Moreover, the material (20) tilts while centering around the center C because the center C of the spherical surface of the hemispherical body (11) is established to be positioned at the bottom surface of the material (20), and the position of the bottom surface of the material (20) does not change even though it is tilted, and polishing can occur.

The pipe (19) is elastic and can absorb some tilting in the hemispherical body (11). Also, the hemispherical body (11) vibrates around the splined shaft (5); therefore, it is designed so that the rotation by the motor (8) is transmitted to the pressing plate (12) and the material (20) when the pin (14) engages with the groove (15).

Problems to be solved by the invention

However, the ability of the pressing plate (12) and material (20) to follow the waviness of the polishing surface (22) was not satisfactory. One factor is the generation of a large amount of

friction between the pin (14) and the groove (15). Figure 3 is a schematic diagram explaining the force that is applied to the pin (14), and it corresponds to the right side surface diagram of the major part in Figure 2. In Figure 3, force b, which is equal to the friction between the material (20) and the polishing surface (22), is applied to the groove (15) from the pin (14) when the splined shaft (5) rotates, as illustrated by arrow a. Furthermore, since a condition is created, in which the right side opens between the material (20) and the polishing surface (22), as illustrated in Figure 1, by the waviness of the polishing surface (22), and if force P is obtained by the piston (6), force P interacts upwards at the left edge of the material (20). To consider the equilibrium of the moment about center C, where the length between center C of the spherical surface of the hemispherical body (11) and the left edge of the material (20) is d and the height between center C and the pin (14) is h, a force of Pd/h is also applied to the pin (14). In practice, this force P becomes considerably large; therefore, a large force also acts on the pin (14), resulting in a large frictional force.

There was also the problem of the pin (14) being constantly pressed toward the left by the groove (15) in Figure 3, causing the pressing plate (12) to swing around the pin (14) according to the waviness of the polishing surface (22), the base ([illegible]) of the pin (14) to change its position to the left or the right relative to the splined shaft (5), and a fluctuation to occur in the rotation of the pressing plate (12).

The aim of the present invention is to offer a workpiece holding mechanism for a plane polishing device in which the aforementioned problems are solved, there is a satisfactory following of the waviness of the polishing surface by tilting of

the workpiece, and the fluctuation in the rotation of the workpiece is reduced for a smooth polishing of the workpiece.

Means to solve the problems

The present invention comprises a holding part (34), which holds the workpiece that is on top of the polishing surface of the plane polishing device and is equipped with a convex spherical surface centering around one point on the surface of the said workpiece to be processed; a support part (32), which is provided for maintaining a constant orientation and is equipped with a concave spherical surface, which engages with the aforementioned convex spherical face in a freely vibrating manner centering about one point on the aforementioned workpiece; and a flexible body (36), which is provided between the aforementioned holding part (34) and the aforementioned support part (32) and has high torsion rigidity but can bend freely.

Function

The elastic body (36), which has torsional rigidity but can bend freely, tilts the holding part (34) against the support part (32) while following the waviness of the polishing surface and not generating a large amount of friction. During this process, the holding part (34) does not separate from the support part (32) in the direction of rotation.

Application example

Next, an application example of the present invention will be explained with reference to a figure. Figure 3 [sic; 1] is a longitudinal section of an application example of the present invention. A disk (1), shaft (2), frame (3), sleeve (4), air cylinder (6), lever (7), motor (8), and gears (9) and (10) are the same as those illustrated in Figure 1 [sic; 2]. A splined shaft (31) is attached to the sleeve (4) so that it can freely oscillate in the direction of the shaft and rotate together with it around the shaft. A hemispherical body (33) engages with the concave part in the form of a spherical surface, which is provided at a flange (32) at the lower end of the splined shaft (31) in a freely oscillating manner. A pressing plate (34) is fixed to the hemispherical body (33). A through-hole (35) of the pressing plate (34) is connected to a pipe (19) in order to hold the material (20) against the pressing plate (34).

The upper end of bellows (36) is fixed to the flange (32) and its lower end to the pressing plate (34). The torsional rigidity of the bellows (36) with respect to the central shaft is high, but it can expand and bend in the direction of the central shaft; therefore, the pressing plate (34) does not separate from the flange (32) in the direction of rotation, but it can tilt freely. Accordingly, a large frictional force is not generated even when the pressing plate (34) is tilted, and the pressing plate (12) and the material (20) satisfactorily follow the waviness of the polishing surface.

The present invention can also be applied to plane polishing devices, in which the disk is fixed, and the pressing plate (34),

for example, rotates together with the frame (3) around the shaft (12).

A steel ball, for example, may also be included between the concave spherical surface of the supporting part and the convex spherical surface of the holding part so that the friction can be reduced.

Furthermore, the elastic body that is provided between the support part and the holding part does not necessarily have the form of a bellows. For example, dividing the bellows in the circumferential direction, in other words, several plate springs that are bent in the middle and arranged over the circumference may also be used.

Effect of the invention

As explained above, in the workpiece holding mechanism for a plane polishing device of the present invention, the holding part is tilted without the generation of a large amount of friction between the groove and the pin by using an elastic body which has torsional rigidity but which can expand and bend freely, instead of an engagement between the groove and the pin, and the workpiece can satisfactorily tilt with and follow the waviness of the polishing surface.

Also, oscillations around the pin are eliminated when the support part is tilted, a fluctuation in the rotating speed of the workpiece can be made very small, and the effect is smooth polishing of the workpiece.

Brief description of the figures

Figure 1 is a longitudinal section of an application example of the present invention. Figure 2 is a longitudinal section of an example of a workpiece holding mechanism for a plane polishing device of the prior art. Figure 3 is a model diagram which explains the force which interacts on the pin (14) as an example illustrated in Figure 2.

1···disk, 5, 31···splined shaft, 11, 33···hemispherical body, 12, 34···pressing plate, 14···pin, 15···groove, 20···material, and 36···bellows.

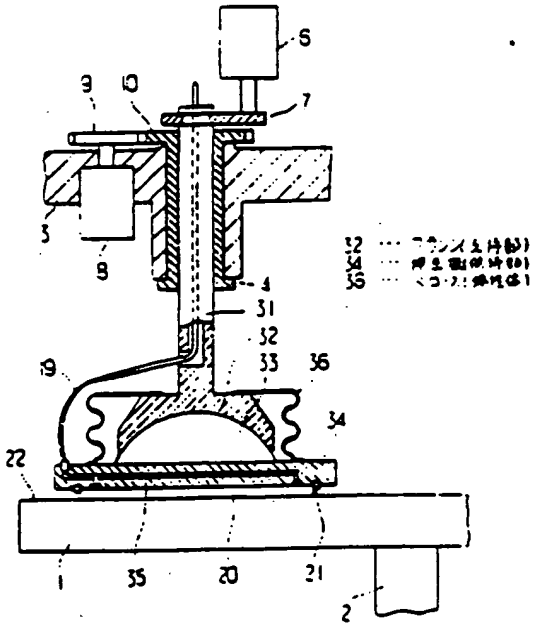

Figure 1

Key: 32 Flange (supporting part)
34 Pressing plate (holding part)
36 Bellows (elastic body)

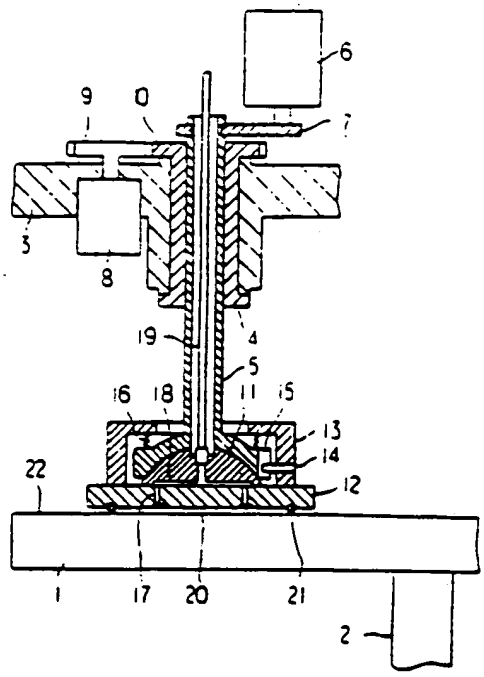

Figure 2

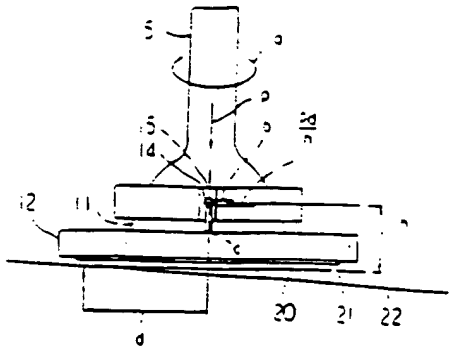

Figure 3

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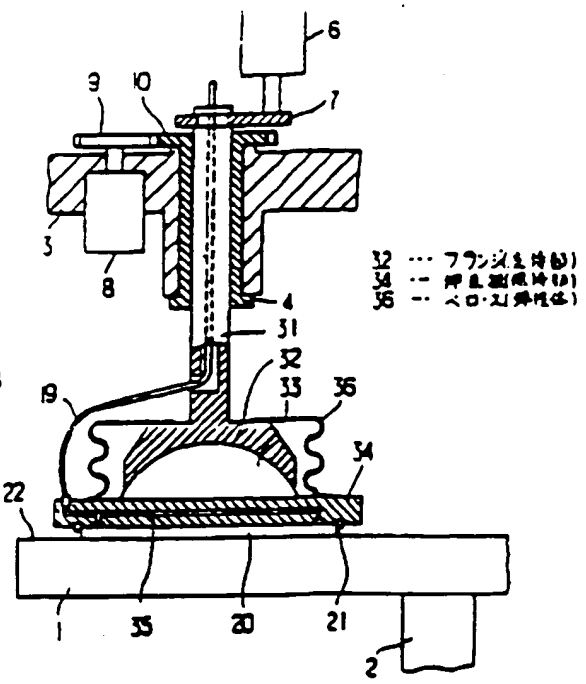

ABSTRACT : PURPOSE:To polish a work smoothly by providing a resilient bellows between the work holding section having convex face and the supporting member having concave face engagable slidably with the convex face.
CONSTITUTION:Semi-spherical body 33 secured to a pressboard 34 i engaged slidably with spherical recess made in the lower end flange 32 of spline shaft 31 to adsorb a material 20 through a hole 35 communicated with a tube 19 to the pressboard 34. A bellows 36 having high rigidity in the rotary direction while flexible against the vertical shrinkage and bending is secured between said flange 32 and the pressboard 34. Consequently, the work 20 or the pressboard 34 will follow the waving of the polishing face 22 well to reduce the fluctuation of the rotary speed of the work 20 thus to polish the work 20 smoothly.

⑲ 日本国特許庁（JP）　　⑪ 特許出願公開

⑫ 公開特許公報（A）　昭61－25768

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7/16		7512−3C	
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㊹発明の名称　平面研摩装置の被加工物保持機構

㉑特　願　昭59−145408

㉒出　願　昭59(1984) 7月13日

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明　細　書

1. 発明の名称

平面研摩装置の被加工物保持機構

2. 特許請求の範囲

(1) 平面研摩装置の研摩盤上の被加工物を保持しこの被加工物の被加工面上の一点を中心とする凸球面を有する保持部と、間隙を一定に保つて設けられ前記被加工物上の一点を中心とし前記凸球面に摺動自在に係合する凹球面を有する支持部と、前記保持部と前記支持部の間に設けられ捩りに対しては剛性が大きく曲げに対しては柔軟な弾性体とを有することを特徴とする平面研摩装置の被加工物保持機構。

3. 発明の詳細な説明

〔産業上の利用分野〕

本発明は、平面研摩装置の被加工物保持機構、特に精密の素部を研摩するための平面研摩装置の被加工物保持機構に関する。

〔従来技術〕

一般に平面研摩装置の被加工物保持機構は、平面研摩装置の研摩盤上の被加工物を保持する保持部を含んで構成され、研摩盤上において被加工物を摺動させて被加工物の表面を研摩している。

第2図は、従来の平面研摩装置の被加工物保持機構の縦断面図である。第2図において平面研摩装置の円盤1は軸2を中心として回転させられる。一方平面研摩装置のフレーム3にはモータ4が垂直自在に取り付けられ、このモータ4の中心穴にスプライン軸5が軸方向は移動自在に回り止めモータ4と一体となつて回転するように取り付けられている。フレーム3に設けられたシリンダ6に取り付けられたレバー7はスプライン軸5に回転自在に係合している。また [illegible] 3に設けたキー8に取り付けた [illegible] に設けた歯車10と噛み合つている。

スプライン軸5の先端に設けた球面状の [illegible] 支持体11が摺動自在に係合している。支持体11には押圧板12が内蔵され、押圧板12には、軸13が設けられている。軸13に設けられたピン14は、スプライン軸5の先端部に設けた溝15に係合している。

スプライン軸5と蓋13の間に設けられた圧縮ばね16は半球体11をスプライン軸5に押し付けるように作用し、スリーブ軸5が上昇したときに半球体11が落下するのを防止している。

押圧板12に設けられた連通孔17及び半球体11と押圧板12の間に設けられた連通孔18は、スプライン軸31に設けた穴を通る管19を介して真空ポンプ（図示省略）に連結され、被加工物である磁気ディスクの素材20を押圧板12に真空吸着するためのものである。また素材20の位置を決めるために押圧板12にリング21が固設されている。

この平面研磨装置で素材20の表面を研磨するには、エアシリンダ8を作動させて押圧板12を上昇させ、素材20を押圧板12の下面のリング21の内側に真空吸着させる。次にモータ6により回転させながら押圧板12をエアシリンダ8により下降させ素材20を円盤1の研磨面22に押し付ける。また図には示していないが研磨面22には、研磨液が滴下されている。従つて素材20の下面は、自からの回転及び円盤1の回転による運動で研磨される。

円盤1の研磨面22は、平面にならすように作られているが実際には僅かであるがうねりが残されている場合が多い。従つて素材20を研磨面22に常に密着させて滑らかに研磨するには、素材20及び押圧板12を研磨面22のうねりに従つて多少傾くことができるようにする必要がある。この傾きは、半球体11のスプライン軸5の球状の凹部との摺動で得られ、しかも半球体11の球面の中心Cが素材20の下面に位置するように設定されているので素材20は中心Cを中心として傾き、傾いても素材20の下面の位置は変化せずに研磨することができる。

なお管19は柔性を有し半球体11の多少の傾きは吸収できる。また半球体11がスプライン軸5に対し摺動するため、ピン14と溝15の係合により押圧板12及び素材20までモータ6による回転が伝わるようにしている。

（発明が解決しようとする問題点）

しかし、押圧板12及び素材20の研磨面22のうねりに対する追従性はあまりよくなかつた。この原因の一つはピン14と溝15の間に大きな摩擦力が生じるためである。第3図は、ピン14に作用する力を説明するための概略図で、第2図の主要部の右側面図に相当する。第3図の矢印aに示すようにスプライン軸5が回転していれば素材20と研磨面22との摩擦力に釣合う力bがピン14により溝15に加えられる。さらに研磨面22のうねりにより素材20と研磨面22との間に第1図に示すように若干の隙間が開く状態になつたとし、ピストン8により力Pが与えられるとすると素材20の左端に上向きに力Pが働く。半球体11の球面の中心Cと素材20の左端までの半径をd、中心Cからピン14までの長さをhとし、中心Cのまわりのモーメントの釣合を考えるとピン14には$\frac{Pd}{h}$の力も作用する。実際には力Pがかなり大きくなるためピン14にも大きな力が作用し大きな摩擦力が生じていた。

また、第3図においてピン14は溝15により常に左向きに押されることとなり研磨面22のうねりに従つて押圧板12はピン14を中心として振り回わされることとなり、スプライン軸5に対して相対的にピン14の位置xは左右に変位し、押圧板12の回転に変動が生じることとなるという欠点があつた。

本発明の目的は、上記欠点を除去し、被加工物の傾きの研磨面のうねりに対する追従性がよく、また被加工物の回転変動を少くして円滑に被加工物を研磨することが可能な平面研磨装置の被加工物保持機構を提供することにある。

（問題点を解決するための手段）

本発明は、平面研磨装置の研磨面上の被加工物を保持しこの被加工物の被加工面上の一点を中心とする凸球面を有する保持部34と、回転を一定に伴つて設けられ前記被加工物上の一点を中心とし前記凸球面に摺動自在に係合する凹球面を有する支持部32と、前記保持部34と前記支持部32との間に設けられ捩りに対しては剛性が大きく曲げに対しては柔軟な弾性体36とを有するものである。

（作用）

ねじりに対しては剛性を有し曲げに対しては柔軟な弾性体36は保持部34を支持部32に対し研磨面のうねりに追従させて大きな摩擦力を生じることなく、揺動させる。この被保持部34は支持部32に

対し回転方向にはずれない。

（実施例）

次に本発明の実施例について図面を参照して説明する。第3図は本発明の一実施例の縦断面図である。円盤1、軸2、フレーム3、メリーフ4、エアリング5、レバー7、モータ8、歯車9,10は第1図に示すものと同じである。スプライン軸31は、他方向には駆動歯車9,10とともに一体となって回転するようにメリーフ4に取り付けられている。スプライン軸31の下端のフランジ33に設けた球面状の凹部に中継体32が揺動自在に係合している。中継体32に押圧盤34が固着されている。押圧盤34の通孔35は管19と連通され空気20を押圧盤34に供給するためのものである。

ベローズ36が上端をフランジ33に固着し下端を押圧盤34に固着して設けられている。ベローズ36は中心軸周りのねじりに対しては剛性が大きいので対し、中心軸方向の伸縮及び曲げに対しては柔軟であるため、押圧盤34はフランジ33に対し軸心方向にはずれないが、しかも自由に傾くことができる。よって押圧盤34が傾くときも入出する空気力に生じ押圧盤12及び空気20の研磨面のうねりに対する追従性はよい。

なお本発明は、円盤が固定してもつてフレーム3とともに押圧盤34等が軸12を中心として旋回するような平面研磨装置にも適用できる。

また支持部の凹球面と保持部の凸球面の間に潤滑剤を介在させて、摩擦力を減少させることもできる。

さらに支持部と保持部との間に設ける弾性体は、必ずしもベローズの形状をしている必要はない。例えばベローズを軸方向に分割したもの、言い換えれば中間を管状をした複数の板ばねを円周上に並べたものでもよい。

（発明の効果）

本発明の平面研磨装置の被加工物保持機構は、以上説明したようにボールとピンの係合の代わりにねじりには剛性を有し伸縮及び曲げに対して柔軟性のある弾性体を使用することにより、軸とピンとの間の大きな摩擦力を発生させることなく保持盤が傾き、研磨面のうねりに対する被加工物の傾きの追従性をよくすることができる。

また保持盤が傾くときにピンを中心として揺動することがなくなり被加工物の研磨速度の変動を非常に小さくすることができ、均一に被加工物を研磨できる効果がある。

4.図面の簡単な説明

第1図は本発明の一実施例の縦断面図、第2図は平面研磨装置の被加工物保持機構の従来の一例の縦断面図、第3図は第2図に示す一例のピン16に作用する力を説明するための模式図である。

1…円盤、5,31…スプライン軸、11,33…中継体、12,34…押圧盤、16…ピン、19…管、20…空気、36…ベローズ。

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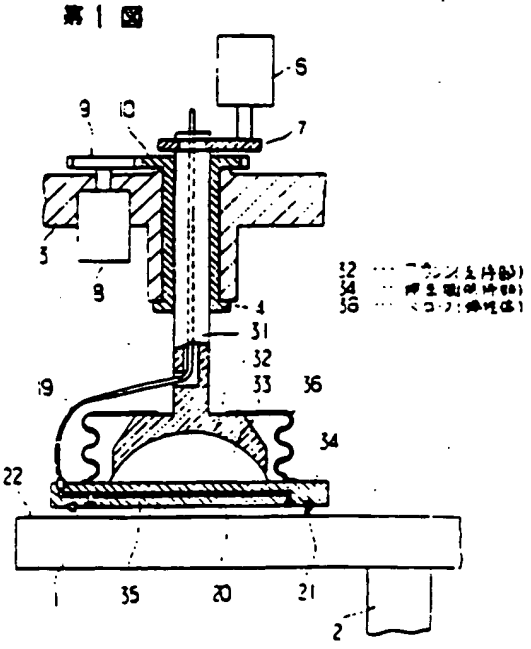
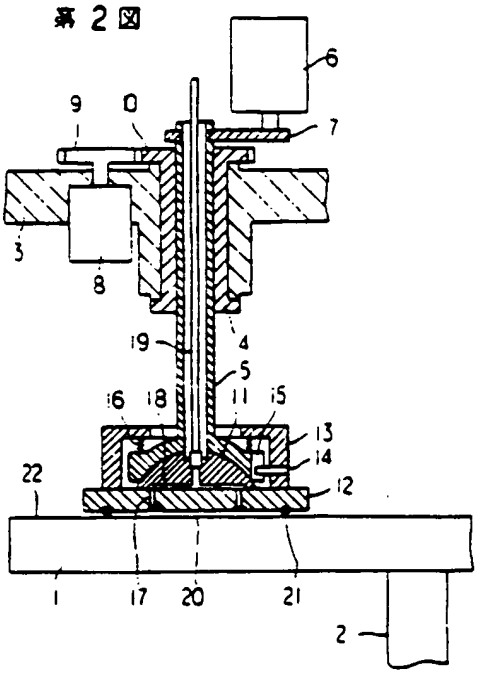
代理人　弁理士　菅　野　中

第1図



第2図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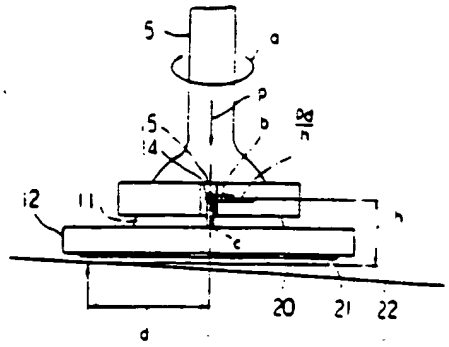
第3図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